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No 61

RESEARCH AID

PRICES OF SOVIET MERCHANT VESSELS 1955

CIA/RR RA 59-7
May 1959

CENTRAL INTELLIGENCE AGENCY
OFFICE OF RESEARCH AND REPORTS

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FOREWORD

This research aid summarizes research accomplished on prices of Soviet merchant vessels. Where possible, prices in rubles are presented in functional relationships relating price to light ship tons. Presented in the appendixes are information and data related to prices of vessels, such as ruble-dollar ratios, the effect on prices of serial construction of vessels, categories for costs of construction, and price indexes for construction of vessels in the US and the USSR.

The research aid was undertaken to fill a continuing need for placing a value on the Soviet effort in shipbuilding in order to assess its relative importance and its role in the Soviet economy. Specifically, the purpose of this research aid is to provide, as an aid for economic studies of Soviet shipbuilding, a means of pricing, in rubles, merchant vessels constructed in Soviet shipyards. This research aid is neither an analysis nor a discussion of factors used and emphasized by the USSR in establishing prices of vessels but rather is an attempt to discover what prices actually are employed so that the value of Soviet shipbuilding can be estimated better in intelligence reports.

CONTENTS

		Page
I.	Introduction	1
	A. Complexity of Prices	1
	B. Bases for Estimating Prices	2
	C. Methods of Estimating Prices	3
II.	Prices	4
	A. Maritime Dry-Cargo Vessels and Tankers	4
	B. River Tugs	5
	C. River Dry-Cargo Vessels	6
	D. River Dry-Cargo Metal Dumb Barges	7
	E. River Passenger Vessels	7
	F. River Petroleum Dumb Barges	7
	G. River Dry-Cargo Wooden Dumb Barges	8

Appendixes

Appendix A.	Statistical Tables	9
Appendix B.	Serial Construction of Soviet Vessels	17
Appendix C.	Categorization of Cost of Construction of Soviet Vessels	19
Appendix D.	Price Indexes for Construction of US and Soviet Vessels	23
Appendix E.	Ruble-Dollar Ratios for Soviet Cargo Vessels	25
Appendix F.	Source References	27

Tables

1.	Soviet Prices of Maritime Dry-Cargo Vessels and Tankers, 1955	10
2.	Soviet Prices of River Tugs, 1955	11

		Page
3.	Soviet Prices of River Dry-Cargo Vessels, 1955 . .	12
4.	Soviet Prices of River Dry-Cargo Metal Dumb Barges, 1955	13
5.	Soviet Prices of River Passenger Vessels, 1955 . .	14
6.	Soviet Prices of River Petroleum Dumb Barges, 1955	15
7.	Soviet Prices of River Dry-Cargo Wooden Dumb Barges, 1955	16
8.	Categorization of Soviet Cost of Construction of Vessels, 1955	20
9.	Categorization of Soviet Cost of Construction of a 2,000-Deadweight-Ton Freighter, 1955	21
10.	Categorization of Soviet Cost of Construction of Serially Constructed Vessels, 1955	22
11.	Index of US Prices for Construction of Vessels, 1939-57	23
12.	Index of Soviet Prices for Construction of Vessels, 1949-55	23
13.	Ruble and Dollar Prices of Soviet Maritime Cargo Vessels, 1955	25
14.	Estimated Characteristics and Prices of Selected Soviet Maritime Cargo Vessels	26

Charts

		Following Page
Figure 1.	USSR: Estimated Prices of Maritime Dry-Cargo Vessels and Tankers, 1955	4
Figure 2.	USSR: Estimated Prices of River Tugs, 1955	4

Following Page

Figure 3. USSR: Estimated Prices of River Dry-Cargo Vessels, 1955 4

Figure 4. USSR: Estimated Average Price of River Dry-Cargo Metal Dumb Barges, 1955 8

Figure 5. USSR: Estimated Average Price of River Passenger Vessels, 1955 8

Figure 6. USSR: Estimated Average Price of River Petroleum Dumb Barges, 1955 8

Figure 7. USSR: Estimated Average Price of River Dry-Cargo Wooden Dumb Barges, 1955 8

PRICES OF SOVIET MERCHANT VESSELS*
1955

I. Introduction.

A. Complexity of Prices.

Estimating prices** of newly constructed merchant vessels*** in the USSR, as elsewhere, is complex and imprecise inasmuch as there are many variables. First, the shipbuilding industry is not essentially a manufacturing enterprise but rather is a construction enterprise devoted to construction of single products. Each of these products is high in value, requiring a long time in construction and varied materials which must be assembled in proper sequence in an irregular hull structure by a variety of trades -- 40 to 160 trades, depending on the organizational structure. Except in construction of very small vessels in large series, shipbuilding is essentially a job shop operation. These factors, in addition to differences in the plant facilities available, the productivity of the labor force, and the efficiency of the management in planning, result in considerable variations in costs.

Each vessel is practically a custom-built product varying from other vessels of the same size and light ship tonnage,**** deadweight tonnage,† or gross register tonnage.†† These variations are influenced

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* The estimates and conclusions in this research aid represent the best judgment of this Office as of 1 March 1959.

** The difference between the terms price and cost as used in this research aid is that price includes profit and turnover taxes and cost does not.

*** The term merchant vessel as used in this research aid comprises vessels of the maritime, inland waterway, and fishing fleets.

**** Unless otherwise indicated, tonnages are given in light ship tons throughout this research aid. Light ship tonnage is the weight (in metric tons) of the vessel complete, ready for service in every respect, including permanent ballast and liquids in the machinery at operating levels but excluding the crew and their effects and all items of consumable or variable load such as stores, fuel, and cargo.

† The deadweight tonnage (DWT) of a vessel is the carrying capacity (in metric tons) of the vessel. It includes the crew and their effects and all items of consumable or variable load such as stores, fuel, and cargo. The deadweight tonnage is the difference in tons between full load tonnage and light ship tonnage. Full load tonnage of a surface vessel is the number of tons /footnotes continued on p. 2/

by the trade route, type of cargo, and so forth, for which the vessel is constructed. Thus vessels of the same tonnage and size may vary in costs and hence in price by as much as 20 to 30 percent.

In addition to the above difficulties, prices of new vessels in the USSR are not set competitively but rather are set arbitrarily by a planning agency and may reflect costs only in a general way. Also, in the USSR, vessels generally are constructed in series rather than in terms of one or two of a model. The effect of these activities generally is to lower the price per vessel.*

All these considerations, in addition to the fact that little probably is known about a newly constructed Soviet vessel except its length, its deadweight tonnage, its gross register tonnage, or its light ship tonnage, cause the estimate of its price to be subject to a wide range of error.

B. Bases for Estimating Prices.

Estimating prices of Soviet vessels, as well as vessels of other countries, depends on the amount of information available regarding the vessels. If only the deadweight tonnage, gross register tonnage, or light ship tonnage is known, the price usually is based on an average price per ton of vessels that are similar in tonnage and for which the price is known. For new construction, it appears that an estimate of the price per light ship ton is best because this tonnage represents the weight of the vessel as actually constructed, whereas the other measures of tonnage -- for example, deadweight tonnage and gross register tonnage -- are related to the carrying capacity of the vessel. The prices per light ship ton vary somewhat with the absolute size of the vessel and with its speed although variation in price per light ship ton is less than in the price per deadweight ton or gross

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(in metric tons) of water displaced by the vessel afloat, fully loaded, including all equipment, outfit, crew and their effects, fresh water, provisions, fuel, and all other items necessary for the operation of the vessel.

†† Gross register tonnage (GRT) is a measure whereby the entire internal cubic capacity of a vessel is expressed in register tons (100 cubic feet per ton). Not included in the measurement are certain spaces such as peak tanks and other tanks of water ballast, open forecastle, bridge and poop, hatchway excess, certain light and air spaces, anchor gear, steering gear, wheelhouse, galley, cabins for passengers, and other minor spaces specified by law.

* See Appendix B.

register ton. For tugs and towboats, because the propulsion machinery represents the major portion of the cost of the vessel, the price usually is quoted according to horsepower.

If additional information is available regarding the vessel, an estimate of price can be made by estimating costs of the machinery and of the hull. In addition, if plans and specifications are available, the estimate can be built up by cost groups.* If data on prices refer to different years, indexes of prices must be used to obtain comparability of data.**

C. Methods of Estimating Prices.

Methods of estimating prices of Soviet vessels, as well as vessels of other countries, depend on the amount of information available about the vessels and on the degree of accuracy desired or necessary. A common method used to price vessels is to establish the price per ton of a vessel of similar size and speed constructed in the US. This method would give the price of the vessel in question if it were constructed in the US. In such a case, a ruble-dollar ratio is necessary to convert the price in dollars to the price in rubles.***

Thus the price per ton is the basis of one of the standard methods used in estimating prices of vessels. The price per light ship ton is preferable to the price per deadweight ton or per gross register ton although these two measures may be used. The reason for this preference is that there is a greater range of variation with reference to size and speed in terms of price per deadweight ton or price per gross register ton than there is in terms of price per light ship ton. For this reason, knowledge of the price per light ship ton allows a greater scope of applicability of a particular price than does knowledge of the price per deadweight ton or per gross register ton, both of which must of necessity be associated with size and speed of the vessel.

Another method of pricing must be used when the only information available is the total tonnage produced of a given type of vessel. Thus it is necessary to establish an average price per ton for all the vessels constructed. In this method it also is necessary to proceed within the bounds of the information available. If the average size of vessels constructed is known, the price per ton for this size of vessel can be used, and all the vessels constructed can be priced in this manner. If this price per ton is not known, an average price per

* See Appendix C.
** See Appendix D.
*** See Appendix E.

ton for this type of vessel must be weighted arbitrarily and the price estimated accordingly. Although this method is less accurate than the method described in the previous paragraph and although the range of error is greater, this method may give a reasonable approximation to the total value of tonnage constructed.

If detailed characteristics of the vessel are known, it is possible to divide the price of the vessel into categories of cost of the hull, cost of machinery, cost of outfit, and profit. It then is necessary to determine the cost per ton for each of these catagories, to add an estimated profit, and so to build up the price of the entire vessel. Differences in speed automatically are taken into consideration in the weight of the machinery. This method, if carefully handled, can be quite accurate within the limits necessary for intelligence work. The great disadvantage of this method, however, is that detailed information on characteristics and on cost per ton of building the hull, the machinery, and the outfit is necessary.

Another aspect of pricing which is even more difficult to handle is the comparison of the prices of vessels serially constructed with the price of a single vessel or with the prices of two or three vessels identically constructed. It is well known that the price per vessel of serially constructed vessels is less than the price per vessel when only two or three vessels are constructed. The US experience in serial construction is difficult to compare with the Soviet experience because maritime cargo vessels seldom are constructed in series in the US. What is needed is a price function relating vessels to marginal price -- that is, the price of an additional vessel. Thus if the marginal price is known and the hull number of the vessel to be priced is known, the price can be determined.

II. Prices.*

A. Maritime Dry-Cargo Vessels and Tankers.

The price per ton for Soviet dry-cargo vessels and for tankers is estimated to range from 11,600 1955 rubles** per ton for a 291-ton vessel to 6,400 rubles per ton for a 5,830-ton vessel, as shown in Figure 1,*** which is based on Table 1.**** The data include the estimated price of the Kazbek-class tanker (4,800 tons), which, as can be seen from Figure 1, is consistent with the prices shown for cargo

* For earlier information on this subject, see source 1/. (For serially numbered source references, see Appendix F.)

** For a discussion of ruble-dollar ratios, see Appendix E.

*** Following p. 4.

**** Appendix A, p. 10, below.

Figure 1

USSR: Estimated Prices of Maritime Dry-Cargo Vessels and Tankers, 1955

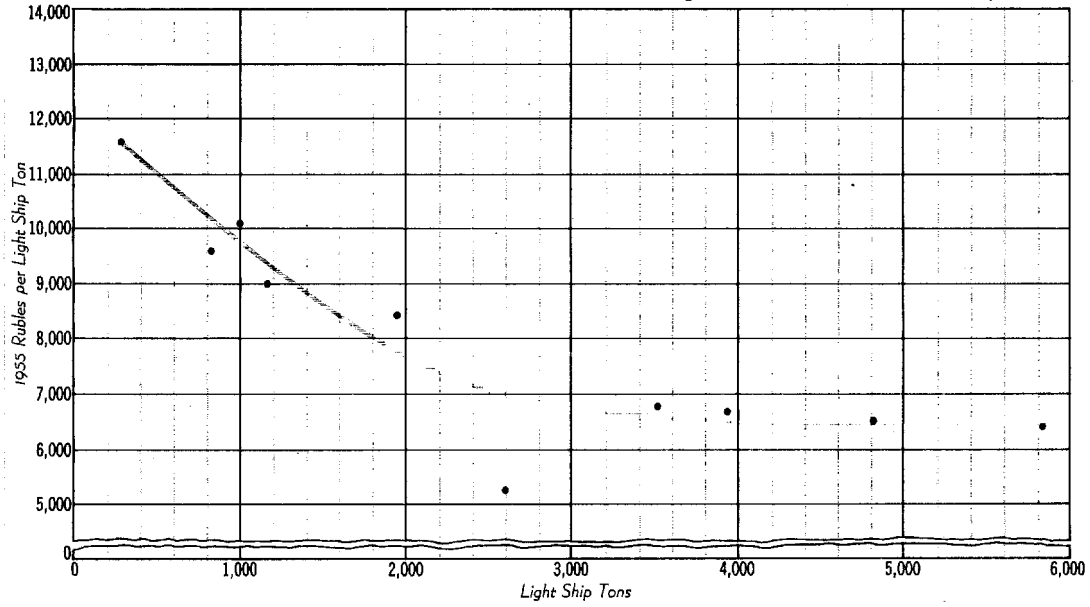


Figure 2

USSR: Estimated Prices of River Tugs, 1955

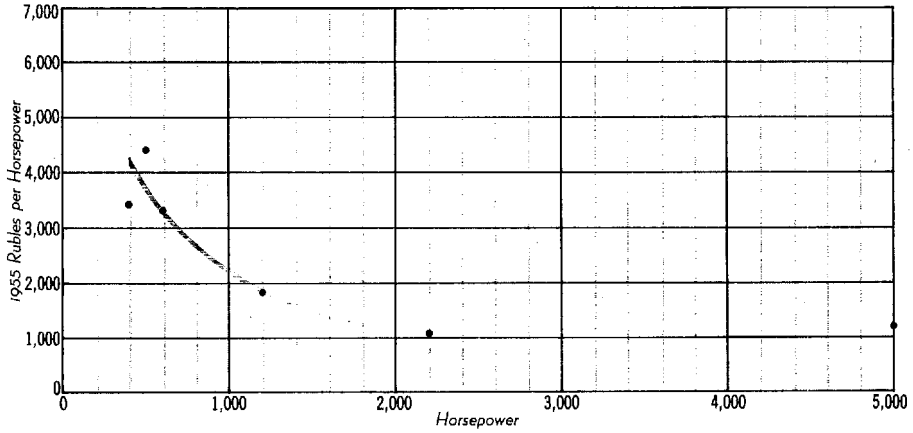
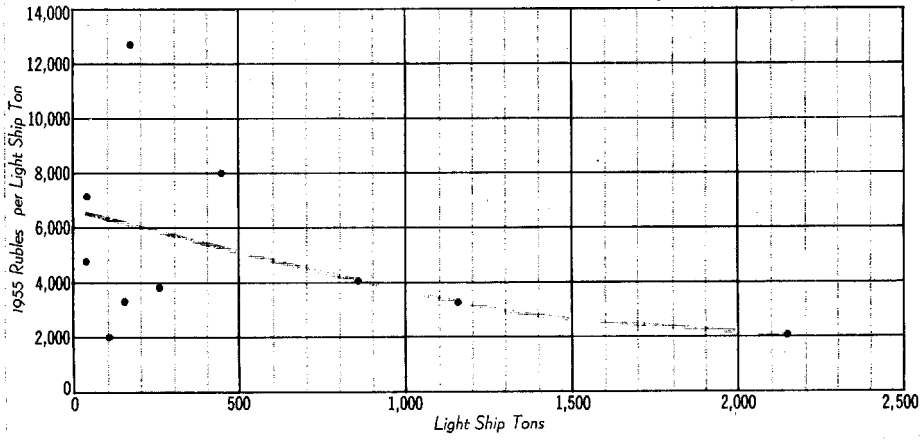


Figure 3

USSR: Estimated Prices of River Dry-Cargo Vessels, 1955



NOTE: The range of prices shown above represents an estimated margin of error of plus or minus 25%

vessels. In addition, seven of the prices used are from a series of price estimates, made by a Soviet writer, for vessels ranging from 291 to 5,830 tons. 2/ These estimates by themselves form a reasonably smooth price curve because they are an internally consistent set of estimates rather than actual shipyard prices, which would not fall on a smooth curve but rather would vary within a range about the curve.

Because it is well known that large variations in costs and hence in prices for constructing the same size and type of vessel are inevitable depending on the shipyard in which the vessel is constructed and on the amount of custom building the purchaser desires, it is estimated that a variation about the price curve shown in Figure 1* of plus or minus 25 percent is quite reasonable and likely.**

A previous publication 3/ on prices of vessels yielded a range of prices for tankers and cargo vessels combined of from 5,000 to 6,400 rubles per ton, which is consistent with the prices shown in Figure 1 for the larger sizes of vessels, given the range of error assigned to the price curve.

B. River Tugs.

The price curve for Soviet river tugs of from 400 to 5,000 horsepower (hp), which is shown in Figure 2* and is based on Table 2,*** indicates that the price of the 400-hp tug is about 4,200 rubles per horsepower. Application of the range of error to the amount of 4,200 rubles per horsepower yields an approximate range of from 3,150 to 5,250 rubles per horsepower. The 5,000-hp tug is priced at about 1,000 rubles per horsepower and has an approximate range of from 750 to 1,250 rubles per horsepower.

Another series of small tugs of from 120 to 300 hp is estimated to average about 1,000 rubles per horsepower. These tugs are quite different from those used to yield the curve in Figure 2. The tonnage of these tugs varies from 20 to 35 tons, as shown in Table 2, whereas the tonnage of the larger, more complicated tugs is estimated to vary from about 250 tons upwards.

* Following p. 4, above.
** All price estimates in this research aid are considered to have the same margin of error (plus or minus 25 percent) for much the same reasons as given here.
*** Appendix A, p. 11, below.

The differences in the characteristics of the two series can be understood from the following:

1. A 290-ton cargo vessel cited in source 4/ has a 500-hp engine weighing about 50 metric tons. On the basis of this example, it might be estimated generally that the engine in the 500-hp tug in the series of large tugs also weighs about 50 tons. Because it is known that the total tonnage of this tug is 279 tons, the weight of the engine is thus about 20 percent of the total, with hull and equipment comprising the other 80 percent.

2. On the basis of a comparison of the engine of the 300-hp tug of the series of smaller tugs with the engine of the 290-ton cargo vessel mentioned in 1, above, it is estimated that the engine of the 300-hp tug weighs about 30 tons. These 30 tons are 85 percent of the weight of the tug, leaving only 15 percent for hull and equipment.

3. A tug of from 120 to 300 hp is made up of an engine in a very simple hull, and the price of the tug depends mostly on the price of the engine, which over the range considered is probably nearly constant in price per horsepower. The larger tugs, of from 400 hp upwards, have much more complicated hulls, and the variation in price per horsepower is influenced heavily by this fact. Consequently, as the size of the hull increases, the price per horsepower of the vessel decreases markedly, because the price per ton to build the hull declines as the size of the hull is increased.

C. River Dry-Cargo Vessels.

Soviet river dry-cargo vessels are estimated to vary in price from 6,400 rubles per ton for 42-ton vessels to 2,050 rubles per ton for 2,150-ton vessels, as shown in Figure 3,* which is based on Table 3.** Application of the range of error to the figure of 6,400 rubles per ton yields an approximate range of from 4,800 to 8,000 rubles per ton and, similarly, to 2,050 rubles per ton yields an approximate range of from 1,540 to 2,560 rubles per ton. These estimates are in a broader range than the range of 5,000 to 6,100 rubles per ton, cited by A.M. Chelnokov in source 5/. The latter range seems most appropriate for vessels smaller than 750 tons. A wide variation in outfitting river dry-cargo vessels is possible as shown by the wide range of prices in Figure 3. Therefore, pricing these vessels is extremely difficult unless much is known of their characteristics. The trend of prices shown in Figure 3, however, is believed to represent the prices for average river dry-cargo vessels, somewhere between the most and the least complex.

* Following p. 4, above.
** Appendix A, p. 12, below.

D. River Dry-Cargo Metal Dumb Barges.

An average price of 2,590 rubles per ton was derived for Soviet river dry-cargo metal dumb barges from data plotted in Figure 4,* which is based on Table 4.** As is true of other estimates made in this research aid, a margin of error of plus or minus 25 percent has been assigned to the average price, which yields an approximate price range of from 1,940 to 3,240 rubles per ton. This range is quite consistent with the range for towed barges given by Chelnokov -- 2,200 to 4,800 rubles per ton. 6/ The broader range given by Chelnokov probably is explained by the fact that Chelnokov considered all barges, whereas the data used in this research aid refer to the simpler types of barges, probably without facilities for crew or for cargo handling.

E. River Passenger Vessels.

On the basis of data shown in Figure 5,* which is based on Table 5,*** the average price per ton for Soviet river passenger vessels was estimated to be about 7,450 rubles. All the vessels considered for this average were single screw vessels and in general were rather small, most of them being from 30 to 40 tons, with the largest vessel in the series being 250 tons.

Chelnokov gave a range of from 7,000 to 8,500 rubles per ton 7/ compared with the range of from 5,590 to 9,310 rubles per ton in this research aid. The difference is explained easily by the small imperfect sample in this research aid. It is believed, however, that the estimates and conclusions in this research aid are consistent with the information given by Chelnokov.

F. River Petroleum Dumb Barges.

From the available data summarized in Figure 6,* which is based on Table 6,**** it is estimated that the average price of Soviet river petroleum dumb barges is 4,850 rubles per ton. This price is based on four items in Table 6 representing barges of from 20 to 135 tons. The range of error of plus or minus 25 percent yields an approximate price range of from 3,640 to 6,060 rubles per ton. This range overlaps the high side of the range of from 2,200 to 4,800 rubles per ton given for towed barges by Chelnokov. 8/

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* Following p. 8.
** Appendix A, p. 13, below.
*** Appendix A, p. 14, below.
**** Appendix A, p. 15, below.

It is to be noted that although the range derived for this research aid for petroleum dumb barges overlaps the upper part of the ranges given by Chelnokov, the range for dry-cargo barges overlaps the lower part. Thus in this research aid, for towed barges generally, a range of from 1,900 to 6,100 rubles per ton has been derived, whereas according to Chelnokov the range is from 2,200 to 4,800 rubles per ton, indicating that the data used in this research aid are in large part consistent with the work of Chelnokov.

G. River Dry-Cargo Wooden Dumb Barges.

Prices available for 15 Soviet river dry-cargo wooden dumb barges of from about 50 to 600 tons averaged about 1,350 rubles per ton, as shown in Figure 7,* which is based on Table 7.** Application of the range of error of plus or minus 25 percent yields an approximate price range of from 1,010 to 1,690 rubles per ton. Data for high-cost Siberian construction, although available, were not used in computing the average price.

* Following p. 8.
** Appendix A, p. 16, below.

Fig. Figure 4

USSR: Estimated Average Price of River Dry-Cargo Metal Dumb Barges, 1955

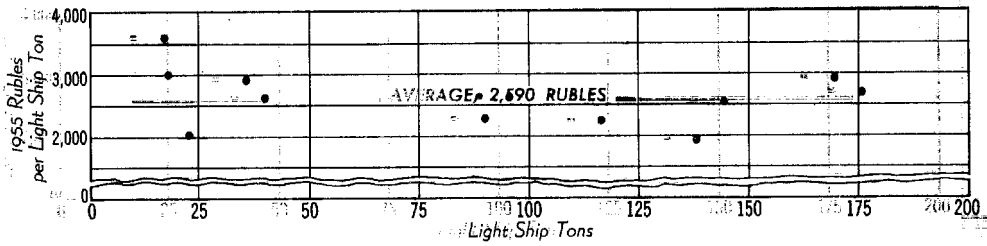


Fig. Figure 5

USSR: Estimated Average Price of River Passenger Vessels, 1955

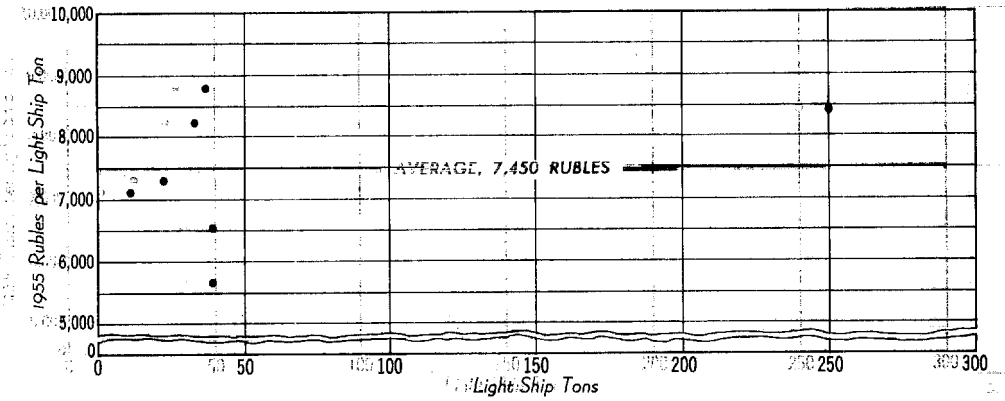


Fig. Figure 6

USSR: Estimated Average Price of River Petroleum Dumb Barges, 1955

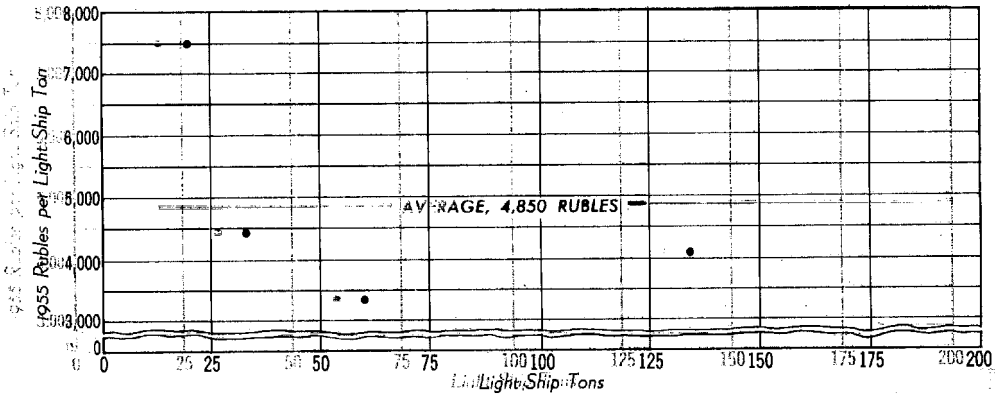
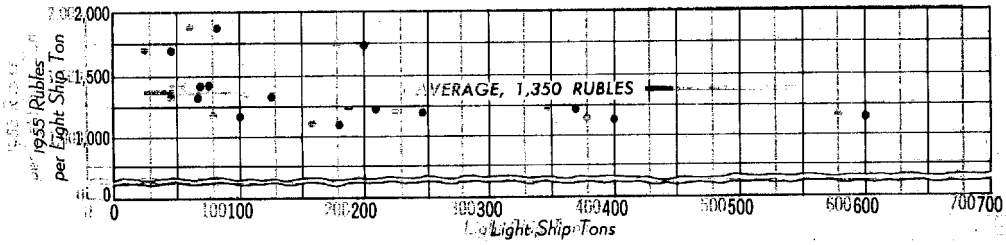


Fig. Figure 7

USSR: Estimated Average Price of River Dry-Cargo Wooden Dumb Barges, 1955



NOTE: The range of prices shown above represents an estimated margin of error of plus or minus 25%.

APPENDIX A

STATISTICAL TABLES

Table 1

Soviet Prices of Maritime Dry-Cargo Vessels and Tankers
1955

Type of Vessel	Light Ship Tons	Price	
		Thousand 1955 Rubles per Vessel	1955 Rubles per Light Ship Ton
Dry cargo	291	3,378 a/	11,609
Dry cargo	820	7,870 a/	9,598
Dry cargo	1,000	10,100 b/	10,100
Dry cargo	1,170	10,530 a/	9,000
Dry cargo	1,950	16,540 a/	8,482
Dry cargo	2,600	13,744 c/	5,286
Dry cargo	3,520	23,900 a/	6,790
Dry cargo	3,945	26,450 a/	6,705
Tanker	4,820	31,400 d/	6,515
Dry cargo	5,830	37,530 a/	6,437

a. 9/
b. 10/
c. 11/
d. 12/

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[redacted]

Table 2

Soviet Prices of River Tugs
1955

Horsepower	Light Ship Tons	Price	
		Thousand 1955 Rubles per Tug	1955 Rubles per Horsepower
5,000	N.A.	6,000 a/	1,200
2,200	N.A.	2,500 a/	1,136
1,200	N.A.	2,200 a/	1,833
600	N.A.	2,000 a/	3,333
500	279	2,219 c/	4,438
400	N.A.	1,378 b/	3,445
300	34	298 c/	993
300	35	350 c/	1,167
300	35	264 c/	880
150	20	137 c/	913
150	22	160 c/	1,067
150	22	127 c/	847
150	21	131 c/	873
120	22	136 c/	1,133
120	22	150 c/	1,250

a. 13/. The price in 1955 was assumed to be the same as the known price in 1957.
b. 14/
c. 15/

[redacted]

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Table 3

Soviet Prices of River Dry-Cargo Vessels
1955

Carrying Capacity (Deadweight Tons)	Horsepower	Light Ship Tons	Price	
			Thousand 1955 Rubles per Vessel	1955 Rubles per Light Ship Ton
5,000 a/	1,800	2,150	4,400 b/	2,047
2,700 a/	1,200	1,161	3,800 b/	3,273
2,000 a/	1,200	860	3,500 b/	4,070
1,000	800	448	3,590 c/	8,013
600 a/	450	258	1,000 b/	3,876
400 a/	300	172	2,200 d/	12,791
349 a/	225	150	500 b/	3,333
60	150	102	206 e/	2,020
60	80	42	206 e/	4,905
60	80	42	302 e/	7,190

a. Deadweight tonnage was not given for these vessels. The relationship of deadweight tonnage to light ship tonnage, however, given by various technical studies is, on the average, for cargo vessels the following: light ship tonnage equals 0.43 of deadweight tonnage.

b. 16/

c. 17/

d. 18/

e. 19/

Table 4

Soviet Prices of River Dry-Cargo Metal Dumb Barges
1955

Carrying Capacity (Deadweight Tons)	Light Ship Tons	Price	
		Thousand 1955 Rubles per Barge a/	1955 Rubles per Light Ship Ton
1,000	176	480	2,727
1,000 b/	176	512	2,909
800	170	500	2,941
600	145	375	2,586
600	138	264	1,913
500	117	265	2,265
300	90	208	2,311
300	96	199	2,073
N.A. c/	96	256	2,667
100	40	105	2,625
100	35.3	105	2,974
60	18.8	57	3,032
50	17.2	62	3,605
50	23.2	47	2,026

a. 20/
b. Equipped for pushing (not counted in the average discussed in II, D, above, and not used in Figure 4, following p. 8, above).
c. Constructed in Siberia (not counted in the average discussed in II, D, above, and not used in Figure 4).

Table 5

Soviet Prices of River Passenger Vessels
1955

Horsepower	Light Ship Tons	Price	
		Thousand 1955 Rubles per Vessel [a]	1955 Rubles per Light Ship Ton
300 [b]	73	1,065	14,589
250	250	2,108	8,432
150	39.4	257	6,523
150	39.4	223	5,660
150 [c]	39.4	285	7,234
150	33	272	8,242
150	37.5	330	8,800
100 [b]	44.5	298	6,697
80	22.8	167	7,334
54	11.5	82	7,130

a. 21/
b. Twin screw vessel (not counted in the average discussed in II, E, above, and not used in Figure 5, following p. 8, above).
c. Constructed in Siberia (not counted in the average discussed in II, E, above, and not used in Figure 5).

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Table 6

Soviet Prices of River Petroleum Dumb Barges
1955

Carrying Capacity (Deadweight Tons)	Light Ship Tons	Price	
		Thousand 1955 Rubles per Barge [a]	1955 Rubles per Light Ship Ton
3,700 [b]	521	2,450	4,702
750	134.5	546	4,059
200	53.2	237	4,455
200 [c]	53.2	284	5,338
150	60	203	3,383
40	20	150	7,500

a. [22]
b. Lake barge (not counted in the average discussed in II, F, above, and not used in Figure 6, following p. 8, above).
c. Constructed in Siberia (not counted in the average discussed in II, F, above, and not used in Figure 6).

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Table 7

Soviet Prices of River Dry-Cargo Wooden Dumb Barges
1955

Carrying Capacity (Deadweight Tons)	Light Ship Tons	Price: Thousand 1955 Rubles per Barge [a]	Price: 1955 Rubles per Light Ship Ton
2,000	600	698	1,163
1,500	370	461	1,246
1,000	400	454	1,135
1,000 [b]	400	536	1,340
600	210	262	1,248
600 [b]	210	302	1,438
600	180	199	1,106
600	248	302	1,218
500	200	349	1,745
340	102	120	1,182
320	125	166	1,328
250	100	116	1,160
230	84	158	1,881
230 [b]	84	183	2,179
100	76	108	1,421
100	70	99	1,414
100	68	91	1,338
100 [b]	68	98	1,441
100	47	80	1,702

a. 23/
b. Constructed in Siberia (not counted in the average discussed in II, G, above, and not used in Figure 7, following p. 8, above).

APPENDIX B

SERIAL CONSTRUCTION OF SOVIET VESSELS

In the USSR the advantages of serial construction of vessels in comparison with unit construction are well understood. Chelnokov stated the following:

> The Socialist national economy commands all the prerequisites for producing the best types of ships for various purposes, for adopting these types as standard for the entire country or for individual basins, and for enabling certain plants to specialize in the building of certain types of ships. The possibilities are even greater for standardization of shipboard equipment, auxiliary mechanisms, installations, and so forth. Realization of these possibilities will facilitate transition from unit to series construction. 24/

There is little doubt that substantial savings could be made in the cost of construction of vessels by constructing vessels in series rather than on the basis of a single vessel. Much of the reduction in cost is the result of better planning of work, more efficient handling of materials, and greater general efficiency of the work force, which has learned how to do its job better.

Because the savings are mostly in costs of labor and engineering, vessels for which large expenditures are made on labor and engineering and for which costs of labor are large percentages of total cost offer greater opportunity for savings in serial construction.

Actual data on reduction of cost as a result of serial construction are sketchy. The US Maritime Administration indicates that the reduction in price for constructing from three to five vessels instead of one is about 15 percent. 25/ Information on construction of towboats and tugs in the US indicates that the price of each of 10 vessels would be about 80 percent of the price of a single vessel. 26/

Soviet information indicates a similar pattern of costs, although the reported reductions for serial construction are somewhat greater. For example, the cost of the third Kazbek-class tanker (10,000 DWT) is reported to have been 74 percent of that of the first. 27/ The cost of the fourth Aktyubinsk-class refrigerator vessel is reported to have been 63 percent of that of the first. Thus a cost plateau

seems to have been reached with the fourth vessel. The series of four refrigerator vessels constructed is as follows 28/:

Vessel	Cost (Percent of Lead Vessel)
Aktyubinsk	100
Akmolinsk	70
Kurgan	64
Zelenogradsk	63

The difference between US and Soviet experience is one of degree rather than of kind. The greater Soviet reductions might be manifestations of pricing the lead vessel relatively higher than would be true under US practice and possibly of "overbuilding" the lead vessel in the sense of using it for experimentation to a greater extent than would be strictly necessary for constructing a single vessel. It is known that under Soviet accounting practice all engineering and preparation costs are charged to the lead vessel, whereas under US accounting practice this cost is spread over the total number of vessels constructed or recorded in an account kept separate from the recurrent costs of construction.

APPENDIX C

CATEGORIZATION OF COST OF CONSTRUCTION OF SOVIET VESSELS

The shipbuilding industry in the USSR classifies categories of cost of construction as follows 29/:

1. Departmental overhead expenses include "outlays for payment of departmental administrative staffs, amortization of buildings and equipment, current repairs of equipment, restoration of tools, heating, lighting, and other outlays for maintenance and administration of departments."

2. Plant-wide overhead expenses include "payment of the plant administrative staff, amortization of plant-wide fixed capital, its current repairs, and other expenses related to plant-wide services."

3. Basic materials include "raw materials and semifinished goods used directly in construction of the ship."

4. Wages of construction workers include "wages of workers engaged directly in construction of the ship."

5. Other direct expenses relate to "special outlays connected with construction of ships of a given type, such as outlays for designing, manufacture of models, special attachments and tools, and the making of special trials."

6. Subcontracted materials include "the cost of the ship's equipment ordered from subcontractors."

Cost of basic materials used in construction of vessels is given as ranging from 30 to 35 percent of total cost of construction, whereas cost for the metal-fabricating industry as a whole is from 50 to 55 percent. Thus cost of basic materials is lower in the shipbuilding industry than in many other metal-fabricating industries of the USSR. 30/

As shown in Table 8,* wages of construction workers range from 12 to 14 percent of total cost of construction of vessels. This range of percentages is similar to that for the metal-fabricating industry in the USSR but almost 50 percent more than that for Soviet industrial production as a whole. Overhead expenses, both departmental and plant-wide, account for from 20 to 25 percent of total cost of construction, which

* Table 8 follows on p. 20.

Table 8

Categorization of Soviet Cost
of Construction of Vessels a/
1955

Category	Percent of Total Cost
Overhead expenses	20 to 25
Basic materials	30 to 35
Wages of construction workers	12 to 14
Subcontracted materials	30
Other direct expenses	2 to 4

a. 31/

also is similar to that for the metal-fabricating industry in the USSR but substantially above the average for all industry. Subcontracted materials account for about 30 percent of total cost of construction, with other direct expenses accounting for from 2 to 4 percent of total cost of construction. 32/

Cost of construction of a 2,000-DWT freighter in rubles, shown in Table 9,* exhibits the same distribution of cost as noted generally in Table 8. Table 10** indicates the same distribution of cost for serially constructed vessels given by another Soviet source. 33/

Thus, according to the Soviet cost structure, both basic materials and subcontracted materials range from 60 to 70 percent of total cost of the vessel. Direct wages range from about 11 to 14 percent, and the balance is composed of overhead and other expenses. Wages as a whole are estimated at about 37 percent of total cost as follows: 39 percent of departmental overhead expenses are wages, 36 percent of plant-wide overhead expenses are wages, 100 percent of wages of construction workers are wages, 10 percent of other direct expenses are wages, and 42 percent of subcontracted materials are wages, all of which yield a weighted average of 37 percent. 34/

In the estimate made by the US Maritime Administration for cost of construction of a Kazbek-class tanker, 35/ basic materials are

* Table 9 follows on p. 21.
** Table 10 follows on p. 22.

Table 9

Categorization of Soviet Cost of Construction
of a 2,000-Deadweight-Ton Freighter a/
1955

Category	Cost (Thousand Rubles)	Percent of Total Cost
Expenses inside the plant		
Overhead expenses		
Departmental	1,210	12.0
Plant-wide	660	6.5
Subtotal	1,870	18.5
Basic materials	3,200	31.7
Wages of construction workers	1,100 b/	10.9
Machine building expenses	400	4.0
Other direct expenses	160	1.6
Subcontracted materials	3,300	32.6
Total	10,030	99.3
Expenses outside the plant	70	0.7
Grand total	10,100	100.0

a. 36/
b. Derived from 50,000 man-days, 2.8 rubles per hour, and 8 hours per day.

estimated at 52 percent of total cost and wages of construction workers are estimated at 28 percent of total cost, with overhead and profit comprising the remainder. If these figures are compared with the situation in general in the USSR, it is noted that wages of construction workers for Soviet shipbuilding (from 12 to 14 percent of total cost) are approximately one-half the US percentage of total cost. The percentage of total cost allocated to materials (basic materials plus subcontracted materials in Table 8*), which in the US is about 50 percent, runs as high as from 60 to 65 percent in the USSR.

* P. 20, above.

Table 10

Categorization of Soviet Cost of Construction
of Serially Constructed Vessels a/
1955

Category	Average Cost (Percent of Total Cost)
Overhead expenses	22 to 24
Basic materials	20 to 30
Wages of construction workers	8 to 12
Miscellaneous expenses	5 to 9
Subcontracted materials	30 to 40

a. These average costs are for various types of vessels. 37/

APPENDIX D

PRICE INDEXES FOR CONSTRUCTION OF US AND SOVIET VESSELS

Presented below are price indexes which aid conversion of prices for construction of US and Soviet vessels from prices of 1 year to prices of another year. Table 11 is an index of US shipbuilding prices, and Table 12 is an index of Soviet shipbuilding prices.

Table 11

Index of US Prices for Construction of Vessels a/
1939-57

Year	Index (1955 = 100)	Year	Index (1955 = 100)
1939	43.0	1949	76.6
1940	44.7	1950	79.4
1941	49.8	1951	86.7
1942	53.6	1952	89.4
1943	56.1	1953	94.1
1944	57.4	1954	95.6
1945	56.5	1955	100.0
1946	61.2	1956	107.0
1947	67.5	1957	113.0
1948	75.2		

a. 38/

Table 12

Index of Soviet Prices for Construction of Vessels a/
1949-55

Period	Index (1955 = 100)
1949 to January 1950	122
January 1950 to July 1950	105
July 1950 to January 1952	109
January 1952 to January 1955	110

a. 39/

APPENDIX E

RUBLE-DOLLAR RATIOS FOR SOVIET CARGO VESSELS

To obtain ruble-dollar ratios for Soviet cargo vessels, prices in rubles were compared with prices in dollars as shown in Table 13. (For details of the estimates of dollar costs, see Table 14.*) The ratios thus obtained varied from a low of 4.9 to 1 for a 1,170-ton vessel to a high of 5.9 to 1 for a 291-ton vessel.

Table 13

Ruble and Dollar Prices of Soviet Maritime Cargo Vessels
1955

	Price			
Light Ship Tons	Thousand 1955 Rubles a/	1955 Rubles per Light Ship Ton	1955 US $ per Light Ship Ton b/	Ruble-Dollar Ratio
291	3,378	11,609	1,983	5.9 to 1
820	7,870	9,598	1,651	5.8 to 1
1,170	10,530	9,000	1,823	4.9 to 1
1,950	16,540	8,482	1,554	5.5 to 1
3,520	23,900	6,790	1,329	5.1 to 1
3,945	26,450	6,705	1,249	5.4 to 1
5,830	37,530	6,437	1,124	5.7 to 1

a. 40/
b. 41/

* Table 14 follows on p. 26.

[redacted]

Table 14

Estimated Characteristics and Prices
of Selected Soviet Maritime Cargo Vessels a/

Item	Unit	250-DWT b/ Vessel	1,000-DWT Vessel	2,000-DWT Vessel	3,000-DWT Vessel	5,000-DWT Vessel	6,000-DWT Vessel	10,000-DWT Vessel
		Soviet Characteristics c/						
Tonnage	Light ship tons	291	820	1,170	1,950	3,520	3,945	5,830
Speed	Knots	10	11	11.5	12	13	13	13
		Estimated Characteristics d/						
Horsepower	Horsepower	500	1,150	2,200	2,640	3,270	3,560	4,730
Steel weight	Metric tons	91	346	574	1,036	1,931	2,317	3,709
Outfit weight	Metric tons	46	152	215	416	813	815	1,054
Machinery weight	Metric tons	153	322	381	498	776	813	1,067
Tonnage	Light ship tons	291	820	1,170	1,950	3,520	3,945	5,830
		Estimated Prices d/						
Hull and miscellaneous	Thousand 1955 US $	177	572	879	1,618	3,043	3,219	4,545
Machinery	Thousand 1955 US $	400	782	1,254	1,412	1,635	1,710	2,010
Total	Thousand 1955 US $	577	1,354	2,133	3,030	4,678	4,929	6,555
Price	1955 US $ per light ship ton	1,983	1,651	1,823	1,554	1,329	1,249	1,124

a. Totals are derived from unrounded data and may not agree with the sum of their rounded components.
b. Deadweight tons.
c. 42/
d. 43/. These characteristics and prices are rough estimates made for the purpose of this research aid.

[redacted]

APPENDIX F

SOURCE REFERENCES

Evaluations, following the classification entry and designated "Eval.," have the following significance:

Source of Information	Information
Doc. - Documentary	1 - Confirmed by other sources
A - Completely reliable	2 - Probably true
B - Usually reliable	3 - Possibly true
C - Fairly reliable	4 - Doubtful
D - Not usually reliable	5 - Probably false
E - Not reliable	6 - Cannot be judged
F - Cannot be judged	

"Documentary" refers to original documents of foreign governments and organizations; copies or translations of such documents by a staff officer; or information extracted from such documents by a staff officer, all of which may carry the field evaluation "Documentary."

Evaluations not otherwise designated are those appearing on the cited document; those designated "RR" are by the author of this research aid. No "RR" evaluation is given when the author agrees with the evaluation on the cited document.

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